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10/551,834	10/17/2006	Gary T. Rochelle	UTSB:719US/10510215	4223

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EXAMINER	
MCKENZIE, THOMAS B	
ART UNIT	PAPER NUMBER
1797	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/551,834	ROCHELLE ET AL.	
	Examiner	Art Unit	
	THOMAS BENNETT MCKENZIE	1797	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *15 June 2010*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-42* is/are pending in the application.

4a) Of the above claim(s) *11-16 and 27* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-10,17-26 and 28-42* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *06/16/2010*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. **Claim 36** is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Specifically, **claim 36** recites the limitations "a piperazine derivative having an amine concentration of 4.0-10.0 equivalents/ Kg water", "an alkali salt having a concentration of 3.0-10.0 equivalents/Kg water" and "the concentration of the piperazine derivative and the concentration of the alkali salt are approximately equal". These limitations would contradict in the event where the piperazine derivative had an amine concentration of 4.0 equivalents/Kg water and the alkali salt had a concentration of 3.0 equivalents/Kg water.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. **Claims 1-10, 17-26 and 28-42** are rejected under 35 U.S.C. 103(a) as being unpatentable over Hakka et al, USP 5,017,350 (Hakka).

6. Regarding **claim 1**, Hakka substantially teaches:

7. a method of removing carbon dioxide from a gaseous stream (column 6, lines 30-40) comprising:

8. contacting a gaseous stream with a solution (column 2, lines 20-30), the solution being formed by combining at least:

9. a primary or secondary polyamine ("piperazine", column 7, lines 45-55) having an amine concentration of about 20 to 90 percent of the absorbing medium (column 8, lines 1-5) which substantially reads on an amine concentration of at least 4.0 equivalents/Kg water, wherein the amines located on the polyamine are not sterically hindered ("piperazine" column 7, lines 45-55) and

10. an alkali salt (column 8, lines 15-20).

11. Although Hakka does not explicitly teach the concentration of the alkali salt, it would have been obvious to one of ordinary skill in the art at the time of the invention to adjust the concentration of the alkali salt to meet the claimed range and thereby produce optimal working results. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." See *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). The discovery of an optimum value of a known result effective variable,

without producing any new or unexpected results, is within the ambit of a person of ordinary skill in the art. See *In re Boesch*, 205 USPQ 215 (CCPA 1980) (see MPEP § 2144.05, II.).

12. Additionally, although Hakka does not explicitly teach no monohydric or polyhydric alcohol is added to the solution, Hakka teaches the absorbing medium can contain only water and an amine sorbent (column 2, lines 60-68). Therefore it would be possible for the method of Hakka to be performed without addition of a monohydric or polyhydric alcohol. Note: for the purposes of examination, monohydric and polyhydric alcohols are defined as alcohols which have no amino groups in addition to one or more alcoholic hydroxyl groups.

13. Furthermore, although Hakka teaches using this solution to remove sulfur dioxide, Hakka teaches that the invention can be used to remove a wide variety of gases including carbon dioxide (column 6, lines 30-50). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to adapt the method of Hakka to remove carbon dioxide.

14. Additionally, the solvents used in Hakka are well known in the art as usable to remove carbon dioxide (as evidenced by Butwell US Pre-Grant Publication 2002/0134241, paragraph 40) and therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use the method of Hakka to remove carbon dioxide.

15. In addition, although Hakka does not explicitly teach regenerating the solution, Hakka does teach using reversible sorbents (column 6, lines 30-40) and alludes to regenerating this solution in column 7, lines 10-20.

16. Furthermore, it is well known in the art to regenerate scrubbing solutions and it would have been obvious to one of ordinary skill in the art at the time of the invention to use such a regeneration process to improve efficiency and reduce operating costs.

17. Regarding **claim 17**, Hakka substantially teaches:

18. a method of removing carbon dioxide from a gaseous stream comprising (column 6, lines 30-40):

19. contacting a gaseous stream with a solution (column 2, lines 20-30), the solution being formed by combining at least:

20. a primary or secondary polyamine ("piperazine", column 7, lines 45-55) having an amine concentration of about 20 to 90 percent of the absorbing medium (column 8, lines 1-5) which substantially reads on an amine concentration of at least 5.1 equivalents/Kg water, wherein the amines located on the polyamine are not sterically hindered ("piperazine" column 7, lines 45-55), and

21. an alkali salt (column 8, lines 15-20).

22. Although Hakka does not explicitly teach the concentration of the alkali salt, it would have been obvious to one of ordinary skill in the art at the time of the invention to adjust the concentration of the alkali salt to meet the claimed range and thereby produce optimal working results. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges

by routine experimentation." See *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). The discovery of an optimum value of a known result effective variable, without producing any new or unexpected results, is within the ambit of a person of ordinary skill in the art. See *In re Boesch*, 205 USPQ 215 (CCPA 1980) (see MPEP § 2144.05, II.).

23. Additionally, although Hakka does not explicitly teach no monohydric or polyhydric alcohol is added to the solution, Hakka teaches the absorbing medium can contain only water and an amine sorbent (column 2, lines 60-68). Therefore it would be possible for the method of Hakka to be performed without addition of a monohydric or polyhydric alcohol. Note: for the purposes of examination, monohydric and polyhydric alcohols are defined as alcohols which have no amino groups in addition to one or more alcoholic hydroxyl groups.

24. Furthermore, although Hakka teaches using this solution to remove sulfur dioxide, Hakka teaches that the invention can be used to remove a wide variety of gases including carbon dioxide (column 6, lines 30-50). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to adapt the method of Hakka to remove carbon dioxide.

25. Additionally, the solvents used in Hakka are well known in the art as usable to remove carbon dioxide (as evidenced by Butwell US Pre-Grant Publication 2002/0134241, paragraph 40) and therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use the method of Hakka to remove carbon dioxide.

26. In addition, although Hakka does not explicitly teach regenerating the solution, Hakka does teach using reversible sorbents (column 6, lines 30-40) and alludes to regenerating this solution in column 7, lines 10-20.

27. Furthermore, it is well known in the art to regenerate scrubbing solutions and it would have been obvious to one of ordinary skill in the art at the time of the invention to use such a regeneration process to improve efficiency and reduce operating costs.

28. Regarding **claim 26**, Hakka substantially teaches:

29. a method of removing carbon dioxide from a gaseous stream (column 6, lines 30-40) comprising:

30. contacting a gaseous stream with a solution (column 2, lines 20-30), the solution being formed by combining at least:

31. a primary or secondary polyamine ("piperazine", column 7, lines 45-55) having an amine concentration of about 20 to 90 percent of the absorbing medium (column 8, lines 1-5) which substantially reads on an amine concentration of at least 4.0 equivalents/Kg water, wherein the amines located on the polyamine are not sterically hindered ("piperazine" column 7, lines 45-55), and

32. an alkali salt (column 8, lines 15-20).

33. Although Hakka does not explicitly teach the concentration of the alkali salt, it would have been obvious to one of ordinary skill in the art at the time of the invention to adjust the concentration of the alkali salt to meet the claimed range and thereby produce optimal working results. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges

by routine experimentation." See *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). The discovery of an optimum value of a known result effective variable, without producing any new or unexpected results, is within the ambit of a person of ordinary skill in the art. See *In re Boesch*, 205 USPQ 215 (CCPA 1980) (see MPEP § 2144.05, II.).

34. Additionally, although Hakka does not explicitly teach no monohydric or polyhydric alcohol is added to the solution, Hakka teaches the absorbing medium can contain only water and an amine sorbent (column 2, lines 60-68). Therefore it would be possible for the method of Hakka to be performed without addition of a monohydric or polyhydric alcohol. Note: for the purposes of examination, monohydric and polyhydric alcohols are defined as alcohols which have no amino groups in addition to one or more alcoholic hydroxyl groups.

35. Furthermore, although Hakka teaches using this solution to remove sulfur dioxide, Hakka teaches that the invention can be used to remove a wide variety of gases including carbon dioxide (column 6, lines 30-50). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to adapt the method of Hakka to remove carbon dioxide.

36. Additionally, the solvents used in Hakka are well known in the art as usable to remove carbon dioxide (as evidenced by Butwell US Pre-Grant Publication 2002/0134241, paragraph 40) and therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use the method of Hakka to remove carbon dioxide.

37. In addition, although Hakka does not explicitly teach regenerating the solution, Hakka does teach using reversible sorbents (column 6, lines 30-40) and alludes to regenerating this solution in column 7, lines 10-20.

38. Furthermore, it is well known in the art to regenerate scrubbing solutions and it would have been obvious to one of ordinary skill in the art at the time of the invention to use such a regeneration process to improve efficiency and reduce operating costs.

39. Regarding **claim 36**, Hakka substantially teaches:

40. a method of removing carbon dioxide from a gaseous stream (column 6, lines 30-40) comprising:

41. contacting a gaseous stream with a solution (column 2, lines 20-30), the solution being formed by combining at least:

42. a piperazine derivative ("piperazine", column 7, lines 45-55) having an amine concentration of about 20 to 90 percent of the absorbing medium (column 8, lines 1-5) which substantially reads on an amine concentration of 4.0-10.0 equivalents/Kg water, wherein the amines located on the piperazine derivative are not sterically hindered ("piperazine" column 7, lines 45-55), and

43. an alkali salt (column 8, lines 15-20).

44. Although Hakka does not explicitly teach the concentration of the alkali salt, it would have been obvious to one of ordinary skill in the art at the time of the invention to adjust the concentration of the alkali salt to meet the claimed range and thereby produce optimal working results. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges

by routine experimentation." See *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). The discovery of an optimum value of a known result effective variable, without producing any new or unexpected results, is within the ambit of a person of ordinary skill in the art. See *In re Boesch*, 205 USPQ 215 (CCPA 1980) (see MPEP § 2144.05, II.).

45. Additionally, although Hakka does not explicitly teach no monohydric or polyhydric alcohol is added to the solution, Hakka teaches the absorbing medium can contain only water and an amine sorbent (column 2, lines 60-68). Therefore it would be possible for the method of Hakka to be performed without addition of a monohydric or polyhydric alcohol. Note: for the purposes of examination, monohydric and polyhydric alcohols are defined as alcohols which have no amino groups in addition to one or more alcoholic hydroxyl groups.

46. Furthermore, although Hakka teaches using this solution to remove sulfur dioxide, Hakka teaches that the invention can be used to remove a wide variety of gases including carbon dioxide (column 6, lines 30-50). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to adapt the method of Hakka to remove carbon dioxide.

47. Additionally, the solvents used in Hakka are well known in the art as usable to remove carbon dioxide (as evidenced by Butwell US Pre-Grant Publication 2002/0134241, paragraph 40) and therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use the method of Hakka to remove carbon dioxide.

48. In addition, although Hakka does not explicitly teach regenerating the solution, Hakka does teach using reversible sorbents (column 6, lines 30-40) and alludes to regenerating this solution in column 7, lines 10-20.

49. Furthermore, it is well known in the art to regenerate scrubbing solutions and it would have been obvious to one of ordinary skill in the art at the time of the invention to use such a regeneration process to improve efficiency and reduce operating costs.

50. Regarding **claims 2, 20 and 28**, Hakka substantially teaches the polyamine is piperazine (column 7, lines 45-55) which substantially reads on the group consisting of piperazine, aminoethylpiperazine, hydroxyethylpiperazine, ethylenediamine or dimethyl ethylenediamine.

51. Regarding **claims 3, 21, 29 and 38**, Hakka substantially teaches the alkali salt is potassium carbonate (column 6, lines 60-65 and column 8, lines 15-20).

52. Regarding **claims 4, 22, 30 and 30**, Hakka substantially teaches the gaseous stream is contacted with the solution at a temperature of approximately 10-60°C (column 8, lines 20-25) which substantially reads on the claimed range of approximately 25-120°C.

53. Regarding **claims 5, 23, 31 and 40**, Hakka substantially teaches the limitations of **claims 1, 17, 26 or 36** as described above. Although Hakka does not teach the rate constant for the reaction of carbon dioxide with the primary or secondary polyamine, the rate constant for the reaction of carbon dioxide with piperazine is known in the art as 53,700 $m^3/kmol-s$ at 25°C (as evidence by "Absorption of carbon dioxide into aqueous piperazine: reaction kinetics, mass transfer and solubility", Sanjay Bishnoi and

Gary Rochelle, Chemical Engineering Science, volume 55, issue 22, November 2000, pp. 5531-5543) which reads on the claimed range of at least 25 $m^3/mol-s$ at 25°C.

54. Regarding **claims 6, 24, 32, and 41**, Hakka substantially teaches the solution comprises an additive (column 6, lines 55-65 and column 8, lines 15-20).

55. Regarding **claims 7 and 33**, Hakka substantially teaches the polyamine concentration and the alkali salt concentration are approximately 20-90 weight percent of the absorbing medium (column 8, lines 1-10) which substantially reads on at least 2.3 m.

56. Additionally, it would have been obvious to one of ordinary skill in the art at the time of the invention to adjust these concentrations in order to optimize results. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." See *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). The discovery of an optimum value of a known result effective variable, without producing any new or unexpected results, is within the ambit of a person of ordinary skill in the art. See *In re Boesch*, 205 USPQ 215 (CCPA 1980) (see MPEP § 2144.05, II.).

57. Regarding **claims 8 and 34**, Hakka substantially teaches the limitations of **claims 1 and 26**, as described above. Although Hakka does not explicitly teach the ratio of equivalents of alkali salt to polyamine, it would have been obvious to one of ordinary skill in the art at the time of the invention to adjust this ratio in order to optimize results. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." See

In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). The discovery of an optimum value of a known result effective variable, without producing any new or unexpected results, is within the ambit of a person of ordinary skill in the art. See *In re Boesch*, 205 USPQ 215 (CCPA 1980) (see MPEP § 2144.05, II.).

58. Regarding **claim 9**, Hakka substantially teaches applying a water wash system, wherein the water wash system collects the polyamine from treated gaseous stream (column 7, lines 50-60 and column 9, lines 1-10).

59. Regarding **claims 10, 25, 35 and 42**, Hakka substantially teaches the limitations of **claims 1, 17, 26 or 36** as described above. Although Hakka does not explicitly teach the comparison of the rate for the solvent-mediated removal of carbon dioxide compared with the claimed solution versus using 5.0-M monoethanolamine, this result would be expected since the components of Hakka are substantially the same as those claimed in instant application.

60. Regarding **claim 18**, Hakka substantially teaches the concentration of the polyamine and the concentration of the alkali salt are approximately 20-90 weight percent of the absorbing medium (column 8, lines 1-10) which substantially reads on at least 5.5 equivalents/Kg water.

61. Regarding **claim 19**, Hakka substantially teaches the limitations of **claim 17**, as described above. Although Hakka does not explicitly teach the concentration of the polyamine and the concentration of the alkali salt are approximately equal, it would have been obvious to one of ordinary skill in the art at the time of the invention to adjust these concentrations in order to produce optimal working results. “[W]here the general

conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." See *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). The discovery of an optimum value of a known result effective variable, without producing any new or unexpected results, is within the ambit of a person of ordinary skill in the art. See *In re Boesch*, 205 USPQ 215 (CCPA 1980) (see MPEP § 2144.05, II.).

62. Regarding **claim 37**, Hakka substantially teaches the piperazine derivative is piperazine (column 7, lines 45-55) which substantially reads on the piperazine derivative is piperazine, aminoethylpiperazine, hydroxyethylpiperazine.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to THOMAS BENNETT MCKENZIE whose telephone number is (571) 270-5327. The examiner can normally be reached on Monday-Thursday 7:30AM-5:00PM Alt. Friday 7:30AM-4:00PM EST..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, DUANE SMITH can be reached on (571) 272-1166. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Duane Smith/
Supervisory Patent Examiner, Art Unit 1797

TBM